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ABSTRACT

In Taiwan, revised curriculum standards for junior and senior high school technology education were developed to take effect in the 1997 and 1998 school years. A project was undertaken to develop a set of exemplar technology learning activities (TLAs) to assist teachers in developing their school-based course of study for the living technology (LT) program; 24 junior high and 9 senior high exemplar TLAs were completed. The curriculum was based on these basic characteristics of a technology education curriculum: negotiation, authenticity, focus, responsiveness, logistics, and expense. The planning team consisted of four industrial arts teachers, two from junior high schools and two from senior high schools. The main procedures were TLA development; TLA tryouts, assessment, and revision; consultant review of TLAs; and final revisions. The finalized TLAs were published in two volumes for junior high and senior high. Each volume contained a preface, list of developers, table of contents, directions, units, and glossary. Each unit consisted of a title, overview, and TLAs (two in each junior high unit and one in each senior high unit). Components of each TLA were as follows: title, teaching hours, grader, performance objectives, introduction, equipment and supplies, activity procedures, evaluation, instructional resources, other suggestions, references, and appendix. (Unit titles are listed. Contains 11 references.
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Running head: EXEMPLAR TECHNOLOGY LEARNING ACTIVITIES

For the Teacher and By the Teacher: Development of Exemplar Technology Learning Activities in Taiwan

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Abstract

In Taiwan, the newly-revised curriculum standards for junior-high and senior-high technology education will, respectively, take effect in the 1997 school year and the 1998 school year. Moving from the current curriculum standards to the new curriculum standards, there will be constitutive changes such as a name change and a reduction in teaching hours. Thus, many school teachers question how effectively the new curriculum standard can be implemented in their school laboratories. In order to assist school teachers to timely and appropriately develop their school-based curriculum, it is necessary to develop some exemplar technology learning activities (TLA's). Funded by the Ministry of Education and the Education Department of the Taiwan Provincial Government, a project team, which was directed by the author and composed of a co-project-director, two project assistants, and 21 school teachers, was organized to develop a set of exemplar TLA's. Based upon the principle of "for the teacher and by the teacher," 24 junior-high and nine senior-high exemplar TLA's were completed in this project. This paper describes the rationale, processes and products of this development project.

For the Teacher and By the Teacher: Development of Exemplar Technology Learning Activities in Taiwan

The Republic of China on Taiwan (henceforth, called the R.O.C. or Taiwan), centered in Taipei, and mainland/communist China (i.e., the People's Republic of China, P.R.C.), based in Beijing, are two separate political entities and are, respectively, located on either side of the Taiwan Strait. In 1996, Taiwan and its 21 million people held a historic election under the shadow of war, which was the center of international attention. On March 23, 1996, the R.O.C. held its first-ever direct presidential election. In order to intimidate Taiwan's people and to influence the outcome of the election, mainland China splashed down missiles near Taiwan's shores and held live-ammunition exercises on Taiwan's doorstep in the run-up to the unprecedented presidential election[1]. However, communist China's military threats turned out to be counterproductive. After Dr. Teng-hui Lee won a landslide victory by accumulating 54% of the vote in a four-way contest, Taiwan was praised as a model of the developing world for its "quiet revolution" process--peaceful transformation from an authoritarian political entity into a multiparty democracy (Editorial, 1996; Editorial, 1997).

As one of the six "Asian Dragons" or Dynamic Asian Economies (DAEs) along with Hong Kong, Malaysia, Singapore, South Korea and Thailand, Taiwan is often praised for its economic prosperity and political democratization. For example, Nomura Research of Japan has predicted that several high-tech industries in Taiwan, including information, telecommunications, semiconductors, computer software, and aerospace, will maintain double digit annual expansion until 2005 (Business Briefs, 1996). Although its economic growth will be somewhat affected by future cross-strait relations, Taiwan will continue to take its rightful place as a respected member of the world community.

It is recognized that through hard work and a willingness to learn, the people of Taiwan have enabled Taiwan hold its head high (DuPont, 1996).Today's Taiwan is an industrialized society with a democratic political system. On this island, importance has always been attached to education by both the government and the people. As reported by Plate (1996), "In contrast, societies such as South Korea and Taiwan practically make a religion of educating all citizens well, regardless of family wealth" (p. 4).

Technology Education Programs in Taiwan Are Moving from Industrial Arts to Living Technology

The present school system in Taiwan is based upon the 6-3-3-4 system: six years in elementary school, three years in lower-secondary (i.e., junior high) school, three years in upper-secondary (i.e., senior high school or senior vocational) school, and typically four years in college or university. Curriculum standards for each school level are determined and promulgated by the Ministry of Education (MOE), and each school's curriculum is planned and authorized textbooks are edited on the basis of the curriculum standard. The curriculum

standard is commonly revised approximately every 10 years. Present elementary-school, junior-high-school and senior-high-school curriculum standards have been, respectively, implemented since the 1978, 1984, and 1984 school years, and their newly-revised curriculum standards will, respectively, go into effect in the 1996, 1997 and 1998 school years.

Technology education (科技教育, pronounced *ke-jih-jiau-yuh* in Chinese) is prescribed in these curriculum standards. The main subject of technology education at the secondary school level is called industrial arts (工藝, pronounced *gong-yih* in Chinese) in the present curriculum standards and will be called living technology (生活科技, pronounced *sheng-hwo-ke-jih* in Chinese) in the new curriculum standards. Thus, technology education in this paper is seen as a general term covering industrial arts and living technology. According to the present and new elementary, junior-high-school, and senior-high-school curriculum standards, the main subjects of technology education can be summarized as shown in Table 1.

Comparison between the present industrial arts (IA) and the new living technology (LT) at least indicates the following obvious changes: (1) In order to emphasize the study of technology to equip youth with living skills needed in a technological society, IA has undergone a name change to LT. (2) In order to reflect the value of gender-equity education, all male and female students will be required to take LT. (3) In order to organize the complicated content domain of IA, the content domain of LT will be more systematic (Lee, 1996).

On the continuum from theory to practice or from general to specific, the following types of school curricula can be distinguished: recommended/ideal curriculum, written/official curriculum, taught curriculum, supported curriculum, tested/measured curriculum, and learned curriculum (Glatthorn, 1987; Morrison & Ridley, 1988). The learned curriculum is the most important of all. It is a crucial task of curriculum leadership to bring those five types of curricula into closer alignment so that the learned curriculum is maximized (Glatthorn, 1987). In Taiwan, curriculum standards are meant to be guidelines for school teachers to help them plan their instruction, for textbook writers to author texts, and for higher-level entrance examiners to design tests. Thus, the technology education curriculum standard is definitely a written/official curriculum which is an instrument of program scope-and-sequence control.

Table 1.

A Brief Summary of the Technology Education Programs Prescribed in the Present and New Curriculum Standards.

School Level	Course Title and Synopsis	
	Present Curriculum Standard	New Curriculum Standard
Elementary (Grades 1-6)	Craft Work （美勞） -Required for all students. -2 hrs/wk for grades 1 and 2, and 3 hrs/wk for grades 3-6. -Consisting of three domains; in the domain of Presentation and Practice[2], painting, sculpture, design, industrial arts, horticulture and home making are incorporated.	Craft Work （美勞） -Required for all students. -2 hrs/wk for grades 1 and 2, and 3 hrs/wk for grades 3-6. -Consisting of three domains; in the domain of Life Practice[3], living technology is emphasized as well as applied arts.
Junior High (Grades 7 -9)	Industrial Arts[4] （工藝） -All students are required to select "Industrial Arts" (IA) or "Home Economics" (HE), but schools commonly assign boys to IA programs. -IA consists of 2 hrs/wk or about 216 hrs in 3 years (i.e., grades 7-9). -IA consists of 13 domains.	Living Technology （生活科技） -All students are required to take "Home Economics & Living Technology" (HE&LT), 2 hrs/wk. -LT in HE&LT consists of 1 hr/wk or about 108 hrs in 3 years. -LT includes 4 domains.
Senior High (Grades 10 -12)	Industrial Arts[5] （工藝） -All students in grades 10 and 11 are required to take IA or HE, but schools commonly assign boys to IA programs. -2 hrs/wk or about 144 hrs in 2 years (i.e., grades 10 and 11). -IA consists of 5 domains.	Living Technology[6] （生活科技） -All students in grades 10 and 11 are required to take HE&LT, 2 hrs/wk. -LT in HE&LT consists of 1 hr/wk or about 72 hrs in 2 years. -LT includes 4 domains, the same as those in junior-high-school LT.

As described earlier, shifting from the current IA curriculum standards to the new LT curriculum standards, there will be constitutive changes--a name change, a reduction in classroom hours etc. Thus, many secondary-school IA teachers question how effectively the new LT curriculum standard can be implemented in their school laboratories. In order to help school teachers implement the new LT curriculum standards in a timely and appropriate manner, it is necessary to develop some exemplar technology learning activities (TLA's) to assist them in developing their school-based course of study. Funded by the MOE and the Education Department of the Taiwan Provincial Government, a project team--composed of 21 IA teachers, two assistant researchers, one project co-director, and one director (i.e., the author)--was organized to develop a set of exemplar TLA's. Based upon the principle of "for the teacher and by the teacher," 24 junior-high and 9 senior-high exemplar TLA's were completed in this project (henceforth, called the TLA project). This paper describes the rationale, processes and products of this development project.

Designing A Taught Curriculum Aligned with the Written Curriculum and Maximizing the Learner Curriculum

Even though technology education is a realm of overall education, a technology education curriculum has certain characteristics that distinguish it from the rest of the educational sphere. These basic characteristics of a technolcgy education curriculum include negotiation, authenticity, focus, responsiveness, logistics, and expense.

1. Negotiation

The curriculum is value-based, and educational ideologies contain values, beliefs and assumptions about learners, knowledge, school, learning, teaching, curriculum etc. Morrison and Ridley (1988) identified three ideologies and their focuses: (1) Progressivism--emphasizing the individual learner, (2) Instrumentalism--emphasizing society, and (3) Conservatism--emphasizing knowledge (see Figure 1). A technology education curriculum is, and should be, negotiable and a compromise between ideal and reality.

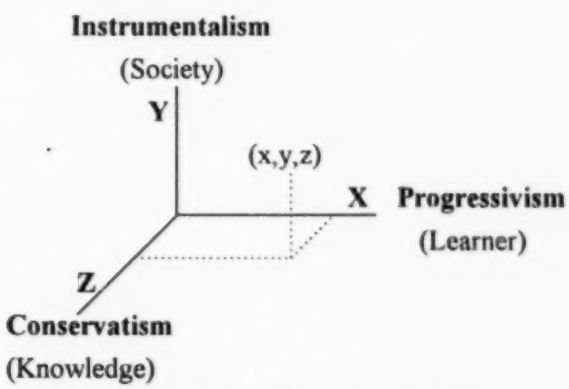

Figure 1. Three ideologies of a curriculum and their respective focus.

2. Authenticity

According to comprehensive learning theories, the majority of youngsters may benefit educationally from concrete experiences involving a variety of senses, and an appropriate learning environment must meditate learners' experiential levels in terms of psychomotor skills and cognitive stages of development. Centered around pragmatic knowledge, technology education is designed to enable youngsters to learn about the influence of technological systems on their total lifestyle. Thus, technology curriculum should be developed with the expectation that instruction will be provided through hands-on, mind-on, laboratory-based activity (The University of the State of New York, 1990).

3. Focus

The curricular focus in technology education is not limited to the development of knowledge about technology itself. A technology education curriculum assists students to develop a broad range of practical knowledge, manipulative skills, and positive attitudes, each of which ultimately contributes in some manner to the students' everyday living skills. The technology education curricular focus also includes integration of academic studies such as mathematics, sciences, and social studies.

4. Responsiveness

A technology education curriculum must be responsive to an ever-changing technological society. Today's students should be technologically literate not only today, but also through out their lives. Thus, not only emerging developments in various technological systems, but also intellectual processes such as self-directed learning, creative problem-solving, and critical thinking skills should be incorporated into a technology education curriculum.

5. Logistics

For all technology educators involved in the implementation of a technology education curriculum, bringing together the proper facilities, equipment, supplies, and instructional resources is a main concern. The logistics associated with operating a technology education curriculum are often complex and time-consuming (Finch & Crunkilton, 1993).

6. Expense

The expenses associated with operating a certain technology education curriculum are often considerably greater than those for its counterparts, such as mathematics, the sciences, and social studies. These expenses include basic operating costs, equipment costs, and consumable materials costs. In order to increase its feasibility and acceptability, a technology education curriculum should emphasize low costs and high performance.

Taking into account the above characteristics of a technology education curriculum, the author firstly organized a planning/core team to design a developmental plan for the TLA project, and then organized the overall project team. The roles of the members and sub-

teams in the project teams are shown in Table 2 and Figure 2.

The planning team consisted of four IA teachers, two from junior-high schools and two from senior-high schools, each of whom also participated in developing TLA's. It should be noted that 17 IA teachers other than these four ones were nominated and screened by all the members of the planning team using, primarily, the following three criteria: (1) experience and knowledge, (2) dedication and flexibility, (3) teaching in the north Taiwan region for the sake of convenience in holding meetings.

Table 2.

The Roles of the Members of the Overall TLA Project Team.

Role, *Sub-team* and **Acronym**	No. of Members	Member Position	Main Responsibilities in This Project
Project-director	1	Teacher educator	1. Manage the overall project 2. Chair of planning, consulting, and overall project team meetings 3. Coordinate with sponsors
Co-project-director	1	Teacher educator	Assist project-director to manage the overall project
Planning Team (P)	*8 (total)*		
1. Director and co-director	2	Teacher educator	(i.e., project-director and co-project-director)
2. Research assistants	2	Teacher Educator	1. Assist project-director in coordinating with team members and sponsors 2. Compile, respectively, junior-high and senior-high TLA's
3. Front-line Practitioners	4	IA teachers	1. Assist in designing a developmental plan 2. Interpret the developmental plan for other project members

Table 2 (continued)

Role, *Sub-team* and **Acronym**	No. of Members	Member Position	Main Responsibilities in This Project
Junior-high Team	*12 (total)*		
*1. J1 team**	*4*	Junior-high IA teachers	Develop eight TLA's for 7th grade
*2. J2 team**	*4***	Junior-high IA teachers	Developing eight TLA's for 8th grade
*3. J3 team**	*4***	Junior-high IA teachers	Developing eight TLA's for 9th grade
Senior-high Team	*9 (total)*		
*1. S1 team**	*4***	Senior-high IA teachers	Develop four TLA's for 10th grade
*2. S2 team**	*5*	Senior-high IA teachers	Develop five TLA's for 11th grade
Consulting Team (JC1-JC3 and SC1-SC2)	*16*	Teacher educators	Review TLA's

* Each team has a team leader.

** Totally, four among them are from the planning team.

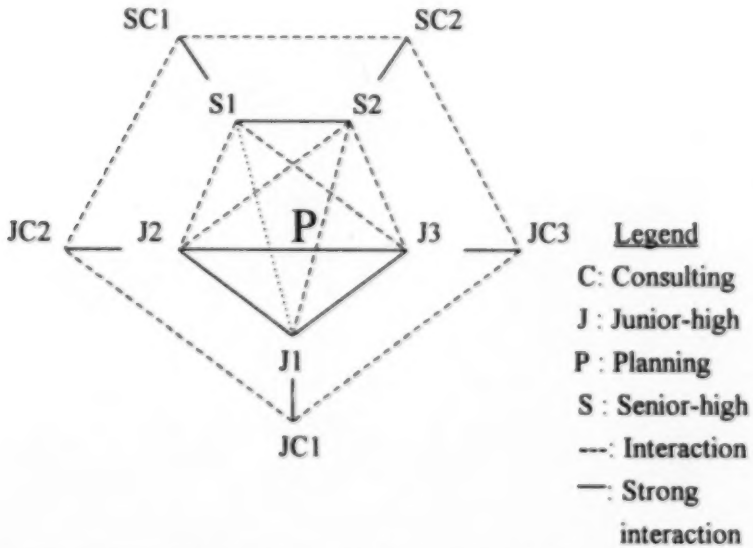

Figure 2. The components and connections of the overall TLA project team.

School teachers have often criticized curriculum products produced by teacher educators as "fast beat but hard to dance to." Obviously, the TLA project is a 10-month collaborative work, sponsored by educational administration institutions, led and advised by teacher educators, and written by front-line school teachers. The main procedures involved in completing the TLA project are as follows:

1. To organize a planning team to draft a developmental plan.
2. To organize the overall project team.
3. To hold an overall project team meeting to decide on a plan and to organize three junior-high sub-teams and two senior-high sub-teams.
4. To develop drafts of the TLA's, based upon the LT curriculum standards.
5. To hold weekly meetings to discuss TLA drafts and solve problems encountered.
6. To consult with teacher educators about TLA drafts and to make necessary revisions.
7. To tryout the TLA's, conduct assessment and make necessary revisions.
8. To exhibit the developed TLA's documents, assessment documents, and students' projects completed in the TLA's and request comments.
9. To make necessary revisions and submit revised TLA's to consultants for review.
10. To make necessary revisions based upon the results of consultants' reviews and to publish and disseminate the TLA's.

The finalized TLA's were published in two volumes for junior-high and senior-high published in October of 1996. Each volume contains a preface, list of the developmental staff, table of contents, directions, units (12 in the junior-high volume and nine in the senior-high one), and glossary. Each unit consists of a title, overview, and TLA('s)(two in each junior-high unit but only one in each senior-high unit). Each TLA has the following components: (1) title, (2) teaching hours (8-10 for each junior-high TLA and 10-12 for each senior-high TLA), (3) grader, (4) performance objectives, (5) introduction to the activity, (6) equipment and supplies, (7) activity procedures, (8) evaluation, (9) instructional resources (with at least two OHP masters), (10) other suggestions, (11) references, and (12) appendix.

Regarding the scope-and-sequence of the TLA's, a two-dimensional cross-table was developed in the planning stage and finally included in the part of Directions to show the relationships among the TLA's and the LT curriculum standards. Table 3 presents all the units and TLA titles. Additionally, all the equipment required in each TLA was also organized into a table shown in the Directions part. This table may be considered a recommendation for updating equipment in current IA labs.

Table 3.

All Units and TLA Titles Completed in the TLA Project.

Junior-high Level	Senior-high Level
7th Grade	**10th Grade**
Unit 1 Technology and Life	**Unit 1 Technology and Life**
TLA 1.1 It's foolish, you're smart	TLA 1 Super sales show
TLA 1.2 A day	**Unit 2 Graphic Communication**
Unit 2 Blue-printing Reading and Design	TLA 2 Graphic design and reproduction
TLA 2.1 Remove my mask	**Unit 3 Electronic Communication**
TLA 2.2 I shrunk my house	TLA 3 V8 videotaping and editing
Unit 3 Computer Applications	**Unit 4 Electronic Sound**
TLA 3.1 A graph is worth a thousand words	TLA 4 Unblowable trumpet
	11th Grade
	Unit 5 Architectural Structure
TLA 3.2 Super advertisement	TLA 5 Suspended highway
Unit 4 Construction and Life	**Unit 6 Manufacturing Technology**
TLA 4.1 Static giant	TLA 6 Medium and small scale manufacturing firm
TLA 4.2 London bridge	**Unit 7 Automation DIY**
8th Grade	TLA 7 Imminent automation
Unit 5 Graphic Communication	**Unit 8 Energy and Power**
TLA 5.1 Red plum flower doesn't fall down again	TLA 8 Wind power generation device
TLA 5.2 Technology treasure	**Unit 9 Technological Wheel**
Unit 6 Introduction to Manufacturing	TLA 9 A long way to go
TLA 6.1 Manufacturing trade and system	
TLA 6.2 Century combat	
Unit 7 Manufacturing and Life	
TLA 7.1 Covering everything	
TLA 7.2 Beautiful etching	
Unit 8 Appliance Design and Making	
TLA 8.1 Full of music	
TLA 8.2 Folk toys	

Table 3 (continued)

Junior-high Level	Senior-high Level
9th Grade	
Unit 9 Energy and Transportation System	
TLA 9.1 Exploring energy	
TLA 9.2 Competing power	
Unit 10 Energy and Power	
TLA 10.1 Electric vehicle	
TLA 10.2 Carousel lamps	
Unit 11 Electronic Communication	
TLA 11.1 Non-advertisement	
TLA 11.2 Kid master	
Unit 12 Transportation World	
TLA 12.1 Love boat	
TLA 12.2 Thunderbolt vehicle	

More Care Is Needed After Sowing Seeds

During the development of TLA's, the 21 IA teachers were impressed by the opportunity over about 10 months to meet consistently their colleagues to share ideas. From the assessment forms completed by students, it was found that almost all of their students enjoyed the TLA try-out period, and that some of these students made constructive suggestions for revising the TLA's.

After publication in October of 1997, a volume of TLA's was distributed to each junior-high school , senior-high school, and consulting IA teacher(s) in every county in the Province of Taiwan at no cost. It seems that the TLA project has sown seeds of the new LT. Hopefully, coupled with other means of regular support, such as teacher training and textbook compilation, these exemplar TLA's will meet school teachers' needs.

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Footnotes

[1]Mainland China's missile tests and military maneuvers led to a security crisis in the Asia-Pacific region. Eventually, the United States sent two aircraft-carrier groups to Taiwan to discourage a rash military confrontation.

[2]The other two domains are Appreciation and Observation, and Inquiry and Discussion.

[3]The other two domains are Performance and Estheticism.

[4]In addition to the required subject, three elective courses pertaining to industrial arts--drafting, metalworking, and electronics--are prescribed in the present junior-high-school curriculum standard.

[5]Some elective courses classified as industrial arts--drafting, metalworking, woodworking, electricity, ceramics etc.--are prescribed in the present senior-high-school curriculum standard.

[6]Additionally, drafting, energy and power, and industrial materials are prescribed as elective courses in the new senior-high-school curriculum standard.